

WHAT IS CLAIMED IS:

1. A two-dimensional scanning apparatus
comprising:

deflecting means for two-dimensionally
5 deflecting a light beam from a light source; and
an optical system for directing the light beam
deflected by said deflecting means on a surface to be
scanned, said scanning optical system including an
optical element which has no reflecting surface
10 having optical power, and is tilted and/or shifted.

2. A two-dimensional scanning apparatus
according to claim 1, wherein the light beam from the
light source is adapted to be obliquely incident on a
15 reflecting surface of said deflecting means, a one-
dimensional direction of the two-dimensional
directions is adapted to correspond to a direction
along a plane of incidence plane of the oblique
incidence, and said optical element is tilted about
20 an axis perpendicular to the plane of incidence
toward a side on which the light beam is obliquely
incident on said deflecting means.

3. A two-dimensional scanning apparatus
25 according to claim 1, wherein in at least a one-
dimensional direction of the two-dimensional
directions, the light beam from the light source is

adapted to be obliquely incident relative to a
central axis of a deflection range of the light beam
deflected by said deflecting means, and said optical
element is tilted in the one-dimensional direction
5 toward a side on which the light beam is obliquely
incident.

4. A two-dimensional scanning apparatus
according to claim 2, wherein said optical element is
10 shifted in the one-dimensional direction.

5. A two-dimensional scanning apparatus
according to claim 2, wherein said optical system
includes a second optical element shifted in the one-
15 dimensional direction, and said second optical
element has no reflecting surface having optical
power.

6. A two-dimensional scanning apparatus
20 according to any one of claims 1 to 5, wherein
distortion on the surface to be scanned is optically
corrected by said optical system, or is corrected by
a combination of optical correction by said optical
system, and electrical correction by a circuit for
25 controlling said deflecting means.

7. An image displaying apparatus comprising:

a two-dimensional scanning apparatus recited in any one of claims 1 to 5; and

means for forming an image on the surface to be scanned, using said two-dimensional scanning
5 apparatus.

8. An image displaying apparatus according to claim 7, further comprising light source means for supplying three colour light beams, such as red,
10 green and blue light beams, and wherein a colour image is formed on the surface to be scanned by causing the three colour light beams to be incident on said deflecting means sequentially and/or simultaneously.

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9. A two-dimensional scanning apparatus comprising:

deflecting means for two-dimensionally deflecting a light beam from a light source; and
20 a scanning optical system for directing the light beam deflected by said deflecting means to a surface to be scanned, said scanning optical system including an optical surface which is tilted at an angle larger than a maximum angle of view relative to
25 a central axis of a two-dimensional deflection range of the light beam deflected by said deflecting means.

10. A two-dimensional scanning apparatus comprising:

deflecting means for two-dimensionally
deflecting a light beam from a light source; and
5 a scanning optical system for directing the
light beam deflected by said deflecting means to a
surface to be scanned, said scanning optical system
including an optical surface which is tilted relative
to a central axis of a two-dimensional deflection
10 range of the light beam deflected by said deflecting
means, and the surface to be scanned being tilted in
the same direction as said tilt optical surface.

11. A two-dimensional scanning apparatus
15 according to claim 9 or 10, wherein an optical
element including said optical surface is tilted at
an angle larger than a maximum angle of view relative
to the central axis of the two-dimensional deflection
range.

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12. A two-dimensional scanning apparatus
according to claim 9 or 10, wherein the tilt
direction of said optical surface is adapted to
correspond to a first one-dimensional direction of
25 the two-dimensional directions.

13. A two-dimensional scanning apparatus

according to claim 9 or 10, wherein the light beam from said light source is adapted to be incident obliquely relative to at least one of two deflection axes of said deflecting means.

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14. A two-dimensional scanning apparatus according to claim 9 or 10, wherein the surface to be scanned is tilted in the same direction as said optical surface tilted relative to the central axis
10 of the two-dimensional deflection range.

15. A two-dimensional scanning apparatus according to claim 9 or 10, wherein said tilted optical surface is shifted relative to the central
15 axis of the two-dimensional deflection range.

16. A two-dimensional scanning apparatus according to claim 9 or 10, wherein where a normal at a surface vertex of said tilted optical surface is
20 extended toward a side of light emergence, said optical surface is shifted relative to the central axis of the two-dimensional deflection range toward a side of extension of the normal.

25 17. A two-dimensional scanning apparatus according to claim 9 or 10, wherein a surface vertex of said tilted optical surface is located outside the

two-dimensional deflection range, and only a portion of said optical surface on one side of a center of coordinates of said optical surface is used to guide the light beam deflected by said deflecting means to
5 the surface to be scanned.

18. A two-dimensional scanning apparatus according to claim 9 or 10, wherein a plurality of said tilted optical surfaces are provided, and tilt
10 amounts of said optical surfaces are different from each other.

19. A two-dimensional scanning apparatus according to claim 9 or 10, wherein a plurality of
15 said tilted optical surfaces are provided, and a tilt angle of said optical surface disposed on a side of the surface to be scanned relative to the central axis of the two-dimensional deflection range is larger than a tilt angle of said optical surface
20 disposed on a side of said deflecting means relative to the central axis of the two-dimensional deflection range.

20. A two-dimensional scanning apparatus
25 according to claim 9 or 10, wherein a plurality of said tilted optical surfaces are provided, and said optical surfaces are shifted relative to the central

axis of the two-dimensional deflection range by shift amounts different from each other, respectively.

21. A two-dimensional scanning apparatus
5 according to claim 9 or 10, wherein a plurality of said tilted optical surfaces are provided, and a surface vertex of said optical surface on a side of the surface to be scanned is more away from the central axis of the two-dimensional deflection range
10 than a normal at a surface vertex of said optical surface on a side of said deflecting means.

22. A two-dimensional scanning apparatus
according to claim 9 or 10, wherein said tilted
15 optical surface comprises an anamorphic surface.

23. A two-dimensional scanning apparatus
according to claim 9 or 10, wherein said tilted optical surface comprises a rotational asymmetrical
20 surface.

24. A two-dimensional scanning apparatus
according to claim 9 or 10, wherein said tilted optical element comprises a meniscus lens whose
25 concave surface faces a side of said deflecting means.

25. A two-dimensional scanning apparatus

according to claim 9 or 10, wherein said tilted optical surface is disposed on a side closest to the scanned surface in said scanning optical system.

5 26. A two-dimensional scanning apparatus according to claim 9 or 10, wherein said tilted optical element comprises a transmission optical element having no reflecting surface.

10 27. A two-dimensional scanning apparatus according to claim 9 or 10, wherein said tilted optical element is formed of plastic material.

28. A two-dimensional scanning apparatus
15 according to claim 9 or 10, wherein all portions on said tilted optical surface used to guide the light beam deflected by said deflecting means to the surface to be scanned are tilted at angles larger than a maximum angle of view relative to the central
20 axis of the two-dimensional deflection range.

29. A two-dimensional scanning apparatus according to claim 9 or 10, wherein there are provided a plurality of said tilted optical elements
25 tilted at angles larger than a maximum angle of view relative to the central axis of the two-dimensional deflection range.

30. A two-dimensional scanning apparatus
according to claim 9 or 10, wherein an angle of view
with respect to a first one-dimensional direction of
the two-dimensional directions is narrower than an
5 angle of view with respect to a second one-
dimensional direction perpendicular to the first one-
dimensional direction.

31. A two-dimensional scanning apparatus
10 according to claim 9 or 10, wherein an angle of view
with respect to a first one-dimensional direction of
the two-dimensional directions is wider than an angle
of view with respect to a second one-dimensional
direction perpendicular to the first one-dimensional
15 direction.

32. A two-dimensional scanning apparatus
according to claim 9 or 10, wherein the light beam
incident on said deflecting means is adapted to be a
20 convergent light beam.

33. A two-dimensional scanning apparatus
according to claim 9 or 10, wherein distortion on the
surface to be scanned is optically corrected by said
25 scanning optical system, or is corrected by a
combination of optical correction by said optical
system, and electrical correction by a circuit for

controlling said deflecting means.

34. An image displaying apparatus comprising:
a two-dimensional scanning apparatus recited in
5 any one of claims 9 to 33; and
means for forming an image on the surface to be
scanned, using said two-dimensional scanning
apparatus.

10 35. An image displaying apparatus according to
claim 34, further comprising light source means for
supplying three colour light beams, such as red,
green and blue light beams, and wherein a colour
image is formed on the surface to be scanned by
15 causing the three colour light beams to be incident
on said deflecting means sequentially and/or
simultaneously.